DOCUMENT RESUME

ED 187 526 SE 030 606

TITLE	Employment of Scientists and Engineers Increased Between 1976 and 1978 but Declined in Some Science Fields. Science Resources Studies Highlights, March 19, 1980.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-80-305
PUB DATE	19 Mar 80
NOTE	8p.; Not available in hard copy due to marginal legibility of original document.
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Employed Women; *Employment Patterns; *Engineers; Minority Groups; Occupational Surveys; Professional Personnel; *Science Careers; Sciences; Scientific Personnel; Scientific Research; *Scientists

ABSTRACT

The data presented in this report are estimates based on information produced by the National Science Foundation (NSF) Scientific and Technical Personnel Characteristics System (STPCS) and other systems of the Foundation, other government agencies and private organizations. Information includes: (1) the U.S. science/engineering force grew by 2% during 1976-78 as contrasted with a 7% growth between 1974 and 1976; (2) the number of employed scientists and engineers grew by 4% over the 2-year period; (3) the fields of chemistry, physics, and earth science showed declines in the number of employees, ranging from 5% to 10%; (4) the fields of computer science and psychology had very high growth rates (over 20%) between 1976-78; (5) the proportion of women scientists and engineers increased; and (6) the number of minority scientists/engineers increased by 10% between 1976-78. (SA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SE

SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 MARCH 19, 1980 NSF 80-305

ED187526

Employment of Scientists and Engineers Increased Between 1976 and 1978 But Declined in Some Science Fields

The data presented in this report are estimates based upon information produced by the National Science Foundation's (NSF) Scientific and Technical Personnel Characteristics System (STPCS) and other national science and engineering (S/E) manpower data emanating from surveys conducted by the Foundation, other government agencies, and private organizations. The STPCS includes three subsystems: (1) the Roster of Doctoral Scientists and Engineers, maintained for NSF by the Commission on Human Resources, National Research Council, consisting of all known doctoral scientists and engineers in the United States starting with 1930. It serves as a panel from which a sample of about 60,000 doctoral scientists and engineers covering the years 1934-76 were selected to provide 1977 data on the doctoral population of the Nation. (2) The Experienced Sample of Scientists and Engineers, consisting of about 50,000 individuals, was drawn from those who were in the employed labor force at the time of the 1970 decennial census. Information on this group is collected by the Bureau of the Census. (3) The New Entrants Surveys are designed to measure the magnitude and characteristics of baccaulaureate and master's-degree scientists and engineers who have entered the S/E labor force since the 1970 decennial census. Samples of the appropriate graduating classes of 1971, 1972, 1973, 1974, 1975, and 1976 were surveyed for NSF by a number of contractors.

The S/E population of the United States as used in this report is defined to include individuals who possessed two of the three following characteristics: (1) Employed as a scientist or engineer; (2) expressed a professional identification as a scientist or engineer or, (3) had a highest academic degree in science or engineering.

Highlights

• The U.S. S/E labor force consisting of about 2.5 million individuals grew by 2 percent during the 1976-78 period, as contrasted with a 7-percent growth between 1974 and 1976. This is smaller than the growth of the total U.S. labor force which rose by almost 5 percent between 1976 and 1978. The decline in the rate of growth of scientists and engineers results from: (1) Fewer new S/E graduates entering the S/E labor force; (2) the net departure of young scientists and engineers (those under 29 years of age) from the S/E labor force, particularly in the fields of chemistry, physics, and sociology, and (3) slightly higher than usual attrition rate (3 percent vs. the usual 2 percent) for those who were in the S/E labor force in 1970.

• The number of employed scientists and engineers grew by 4 percent over the 2-year period, with a 6-percent growth rate reported by scientists and 2 percent by engineers. The overall rate is about one-half the rate at which the professional technical and kindred (PTK) workers grew during the same period. The higher rate of growth of scientists (compared to that of engineers) between 1976 and 1978 continues a long-term trend which began in the late sixties and reflects a shift away from engineers and toward scientists, particularly computer specialists, life scientists, and psychologists who had growth rates greater than 4 percent. In the midsixties there were approximately two employed engineers for every employed scientist—by 1978 this ratio had changed to almost one to one. More recent trends may have reversed this secular shift toward scientists.

• The fields of chemistry, physics, and earth sciences showed declines in the number of employed ranging from 5 percent to 10 percent. These downward trends appear to be concentrated among those who are white, male, held a bachelor's degree, and were under the age of 40. The concentration in the under 40 age groups suggests that career adjustments may be taking place which involve either mobility between fields of science or leaving science completely.

• The fields of computer science and psychology reported very high growth rates—over 20 percent—between 1976 and 1978. The increase in computer science reflects both the increase in the number of degrees awarded and mobility from other fields. The increase in the field of psychology is the result of the high rate of increase of master's degrees awarded over the past few years (about 10 percent per year compared

Prepared in the Demographic Studies Group, Division of Science Resources Studies

SE 030 606

APR 17 1980

to 0.5 percent for all scientists and engineers) plus an improvement in the employment situation for psychologists.

- The unemployment rate for both scientists and engineers was about 1.5 percent, roughly one-half the 1978 unemployment rate for PTK workers.

- The unemployment rate for the S/E population dropped from 3.0 percent in 1976 to 1.4 percent in 1978.

- Business and industry continued to employ most of the scientists and engineers (62 percent) and showed a growth rate of 7 percent between 1976 and 1978. Educational institutions, the employer of the second largest number of scientists and engineers grew by only 3 percent, reflecting economic strains and leveling enrollments. The next largest employer was the Federal Government which reported no appreciable growth in the utilization of scientists and engineers.

- Research and development continues to be the major primary work activity of 27 percent of the employed scientists and engineers, followed by management or administration, and then teaching. Research and development and management or administration both grew by about 9 percent between 1976 and 1978 while teaching showed a 7-percent growth rate.

- The proportion of women in the S/E population increased. The growth rates for women and men were 6 percent and 1 percent, respectively. Employment of women scientists increased by 11 percent (compared to 5 percent for men) indicating that affirmative action plans may be having an effect on employers of scientists. Although their number continues to be relatively small, women engineers continued to report large gains relative to male engineers.

- Women scientists and engineers had a 2.4-percent unemployment rate which was the same as for women in the PTK occupation group. Men had 1.3-percent rate—almost one-half of the rate of PTK men.

- Employment of women scientists increased dramatically in educational institutions in the period 1976-78 (30 percent). This increased their proportion from 18 percent to 23 percent in this sector.

- The number of minority scientists and engineers in the labor force increased by 10 percent between 1976 and 1978. Growth in minority employment was 14 percent during the 2-year period, again suggesting that affirmative action plans are having an effect in S/E labor markets. Asians continue to be the largest minority group within the S/E population.

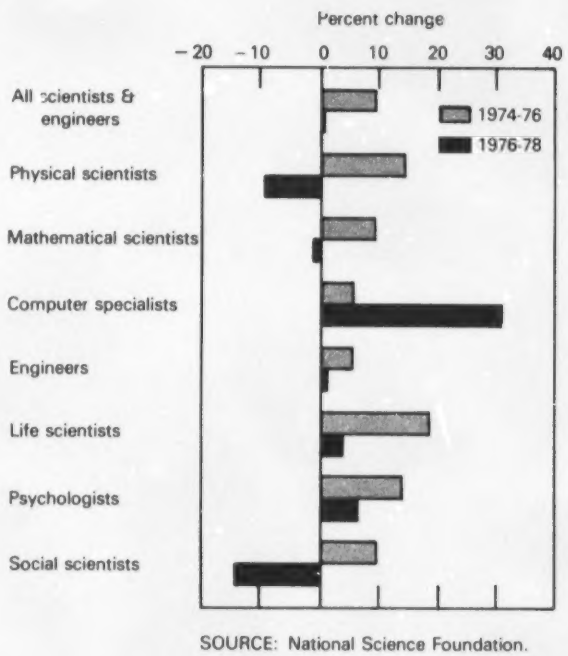
S/E Population: Demographic Characteristics

The total population of scientists and engineers in the United States in the spring of 1978 was estimated to be 2.7 million individuals—1.3 million scientists and 1.4 million engineers. The S/E population grew by 1 percent between 1976 and 1978 compared to a 9-percent growth between 1974 and 1976 (chart 1). The ratio of women to men in the S/E population has remained fairly consistent since 1972—slightly less than 1 in 10. Among scientists the ratio of women to men was 1 in 5, whereas the ratio among engineers was 1 in 65. Racial minority groups comprised more than 4 percent of the S/E population with their representation being about the same among scientists and engineers—5 percent and 4 percent, respectively.

The proportion of scientists and engineers under 30 years of age has declined from 30 percent to 24 percent between 1976 and 1978. This has caused the median age of the S/E population to rise to 38 years (compared to 36 years in 1976). Scientists reported a 1978 median age of 35 years (compared to 33 in 1976) and engineers reported a median age of 41 years (compared to 40 in 1976). The decline of young scientists and engineers was pronounced in the fields of chemistry, physics, and earth sciences and was concentrated among white males who held bachelor's degrees.

An increase in the number of those with master's and doctoral degrees and a drop in the number with bachelor's degrees caused the overall level of educational attainment of the S/E population to rise. Almost 40 percent of the S/E population held a graduate degree with scientists reporting 57 percent and engineers 23 percent. This represents a growth rate of 15 percent in the number of graduate degrees held over the 2-year period, contrasted with a decline of 6 percent in the number of individuals with a baccalaureate or less.

Chart 1. Percent change in population of U.S. scientists and engineers by field: 1974-76 and 1976-78



SOURCE: National Science Foundation.

The S/E population was almost evenly divided between scientists and engineers. Within the sciences there was a decline in the number of physical, mathematical, environmental, and social scientists between 1976 and 1978. At the same time, there was an increase in the number of life scientists, psychologists, and computer specialists. The largest engineering fields were electrical/electronic, mechanical, and civil, representing 17 percent, 17 percent, and 13 percent, respectively, of the engineering population (table 1).

The S/E Labor Force

Around 91 percent of the S/E population was in the labor force, that is, they were employed or seeking employment. This is a high participation rate when compared to the general population rate of 64 percent. The S/E labor force participation rate has remained relatively steady for the past few years, but the rate for women has increased during the period 1976-78 from 85 percent to 89 percent.

Although there have been recent population declines in some S/E fields, these declines were not necessarily fully reflected in labor force declines. The labor force could, in principle, decline relatively more rapidly, at about the same rate as, or less rapidly than the population, depending on whether the labor force participation rate (i.e., the proportion of the population that is in the labor force) is decreasing, remaining stable, or increasing. Among the populations that declined between 1976 and 1978 the labor force participation rate remained level for the physical sciences and dropped for the social sciences. As a result, changes in fields which showed increases in population also were not uniform. The labor force participation rate for psychologists increased from 86 percent in 1976 to

Table 1. Employment characteristics of scientists and engineers by field: 1976 and 1978

(In thousands)

Field	Total		Employed		Unemployment rate[1]	
	1976	1978	1976	1978	1976	1978
Total, all fields	2,706	2,741	2,377	2,473	3.0	1.4
Physical scientists	281	255	227	212	4.2	2.0
Chemists	186	174	150	144	4.3	2.0
Physicists/astronomers	70	62	59	51	3.6	2.1
Other physical scientists	25	19	19	17	5.1	1.8
Mathematical scientists	110	108	88	88	4.2	1.5
Mathematicians	98	97	78	80	4.2	1.5
Statisticians	13	11	10	8	4.7	1.4
Computer specialists	180	238	172	234	.6	.3
Environmental scientists	86	81	75	72	3.4	2.3
Earth scientists	80	71	70	63	3.5	2.5
Oceanographers	2	2	2	1	(2)	(2)
Atmospheric scientists	4	8	4	8	(2)	(2)
Engineers	1,375	1,396	1,241	1,268	2.1	1.3
Aeronautical/astronautical	NA	49	NA	44	NA	.6
Chemical	NA	68	NA	62	NA	1.1
Civil	NA	184	NA	170	NA	3.2
Electrical/electronics	NA	243	NA	232	NA	.5
Mechanical	NA	234	NA	224	NA	.6
Other engineers	NA	620	NA	537	NA	1.3
Life scientists	314	328	278	291	3.1	1.7
Biologists	140	154	119	131	4.2	1.7
Agricultural scientists	129	130	114	118	2.7	2.0
Medical scientists	46	44	45	42	.7	.3
Psychologists	123	132	98	121	7.6	1.8
Social scientists	237	205	198	186	6.2	1.3
Economists	60	59	51	53	1.4	1.0
Sociologists/anthropologists	51	45	36	38	15.9	4.2
Other social scientists	127	102	112	96	4.9	.4

[1] The following are the sampling errors associated with the unemployment rates by fields of science and engineering: Less than 20 percent—physicists, other physical scientists, earth scientists, chemical engineers, civil engineers, other engineers, biologists, psychologists and sociologists; less than 30 percent—mathematicians, statisticians, and agricultural scientists; less than 40 percent—chemists, computer specialists, mechanical engineers, electrical/electronics engineers, medical scientists, economists, and other social scientists. These errors can be used to draw inferences about the estimates at the 95-percent level of confidence.

[2] Too few cases to compute.

Note: Detail may not add to totals because of rounding.

Source: National Science Foundation.

93 percent in 1978, while the rate for computer specialists rose only slightly (from 96 percent to 98 percent). The latter rate for computer specialists is approaching the upper limit of an attainable labor force participation rate, which is why the growth was so small.

The S/E unemployment rate in 1978 was 1.4 percent, down from 3.0 percent in 1976 and was about one-half that of PTK workers rate and about one-fourth the national unemployment rate.[1] There was little difference between the unemployment rates of scientists and engineers—1.4 percent for scientists and 1.3 percent for engineers (table 1).

Employed Scientists

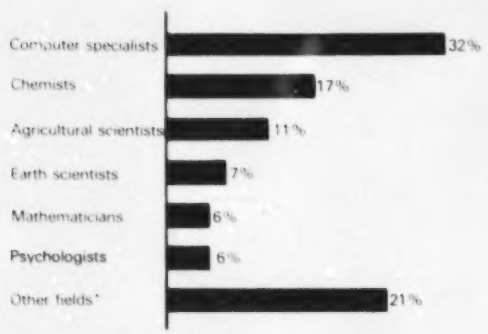
About 90 percent of the 1.3 million scientists were employed in 1978, up 6 percent from 1976 employment levels. Business and industry was the major employer with educational institutions, government at all levels, and other employers following. The distribution of primary work activities differed between scientists and engineers (chart 2).

BUSINESS AND INDUSTRY

Business and industry increased its employment of scientists by about 15 percent between 1976 and 1978.

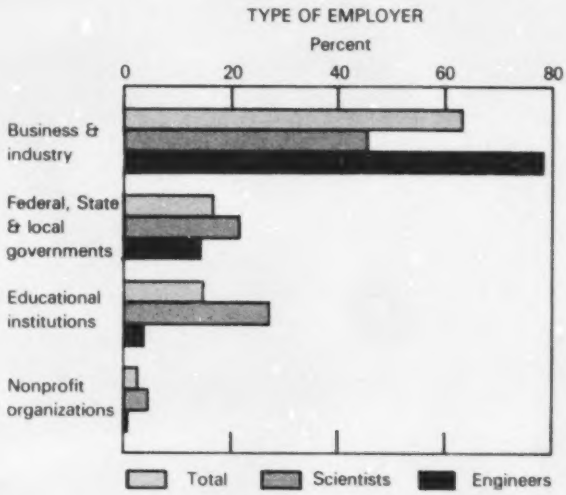
Of the 543,000 industrially employed scientists, 37 percent were primarily engaged in R&D activities (including management). Over 60 percent of these R&D scientists were involved with applied research or development (chart 3).

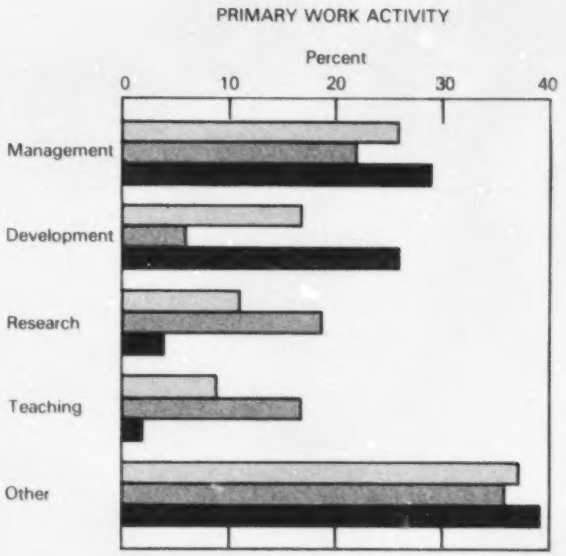
In terms of field of science, one-third of the scientists employed in this sector were computer specialists.



*Includes other social scientists (6 percent), biologists and economists (each 4 percent), and all other fields (7 percent).

Chart 2. Employed scientists and engineers: 1978





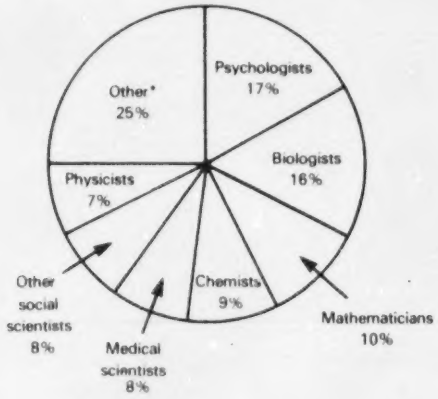
SOURCE: National Science Foundation.

EDUCATIONAL INSTITUTIONS

Employment in education institutions, the second largest employer of scientists, was roughly stable between 1976 and 1978; the increase was only 2 percent compared to the 10 percent rate of growth experienced in earlier years. The major reasons for the slow down in the rate of growth were demographic and economic—enrollments, particularly at the undergraduate level, have leveled off or begun to decline as the school-age population peaked and as economic returns to higher education have diminished.

Over one-half of the scientists in educational institutions reported their primary work activity as teaching and one-fourth as research and development including its management (chart 3).

One-third of the educationally employed scientists were either psychologists or biologists.

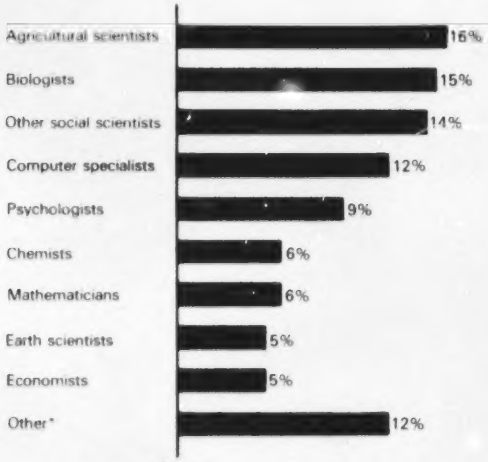


* Includes agricultural scientists, computer specialists, economists, sociologists/anthropologists, and other, each representing 5 percent.

GOVERNMENT

Government organizations at all levels employed about 240,000 of the scientists. This level of employment reflects a growth of about 12 percent over the period 1976-78. Over one-half of the governmental scientists were engaged in activities involving research and development (chart 3).

Biologists and agricultural scientists constituted about one-third of the governmental scientists.



* Includes physicists and sociologists/anthropologists, each 3 percent and other fields, 6 percent.

OTHER EMPLOYERS

Other employers, including nonprofit organizations, accounted for the remaining 7 percent of the employed scientists. Employment of scientists in this sector declined by over 25 percent in the 2-year period.

Employed Engineers

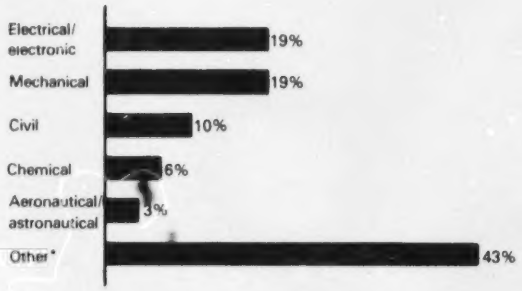
Of the 1.4 million engineers in the Nation, 1.3 million were employed. Business and industry along with government employed 95 percent of the engineers with industry being the largest user. Although work activities varied from one sector to another, about three-fourths of the employed engineers were engaged in development, managerial activities, or production/inspection (chart 2).

BUSINESS AND INDUSTRY

Business and industry increased its employment of engineers by almost 3 percent during the period 1976-78 by utilizing around 986,000 engineers in 1978.

Over 40 percent of the industrially employed engineers were engaged in R&D work, including its management, with an overwhelming proportion active in development work (chart 3).

Within industry, electrical/electronic and mechanical engineers were the largest fields, each constituting about one-fifth of the engineers.



*Only five explicit fields were identified.

EDUCATIONAL INSTITUTIONS

Educational institutions—a major employer of scientists—employed relatively few engineers, 4 percent of the employed engineers.

Teaching and R&D activities were the primary work activities of most educationally employed engineers (chart 3).

Over one-half of the educationally employed engineers were mechanical, electrical, and civil engineers.

GOVERNMENT

Governmental organizations, at all levels employed the second largest number of engineers, 190,000, reflecting a growth of about 11 percent between 1976 and 1978.

Work activities involving research and development were reported by over one-third of the governmental engineers with about one-half of these being concerned with development (chart 3).

Governmental engineers were concentrated in the same three fields as academic engineers, with civil engineers forming the largest proportion (36 percent) followed by electrical/electronic engineers (17 percent) and mechanical engineers (10 percent).

OTHER EMPLOYERS

Other employers, including nonprofit organizations, employed 3 percent of the engineers. Over one-third of these 27,000 engineers reported that they were employed but gave no work activity and no type of employer. Another one-third indicated they were engaged in R&D activities and the remaining one-third reported other activities. Of the identified engineering fields, electrical/electronic and mechanical showed the largest numbers (around 5,000 each.).

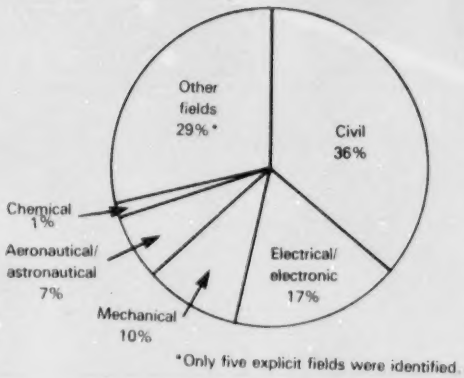
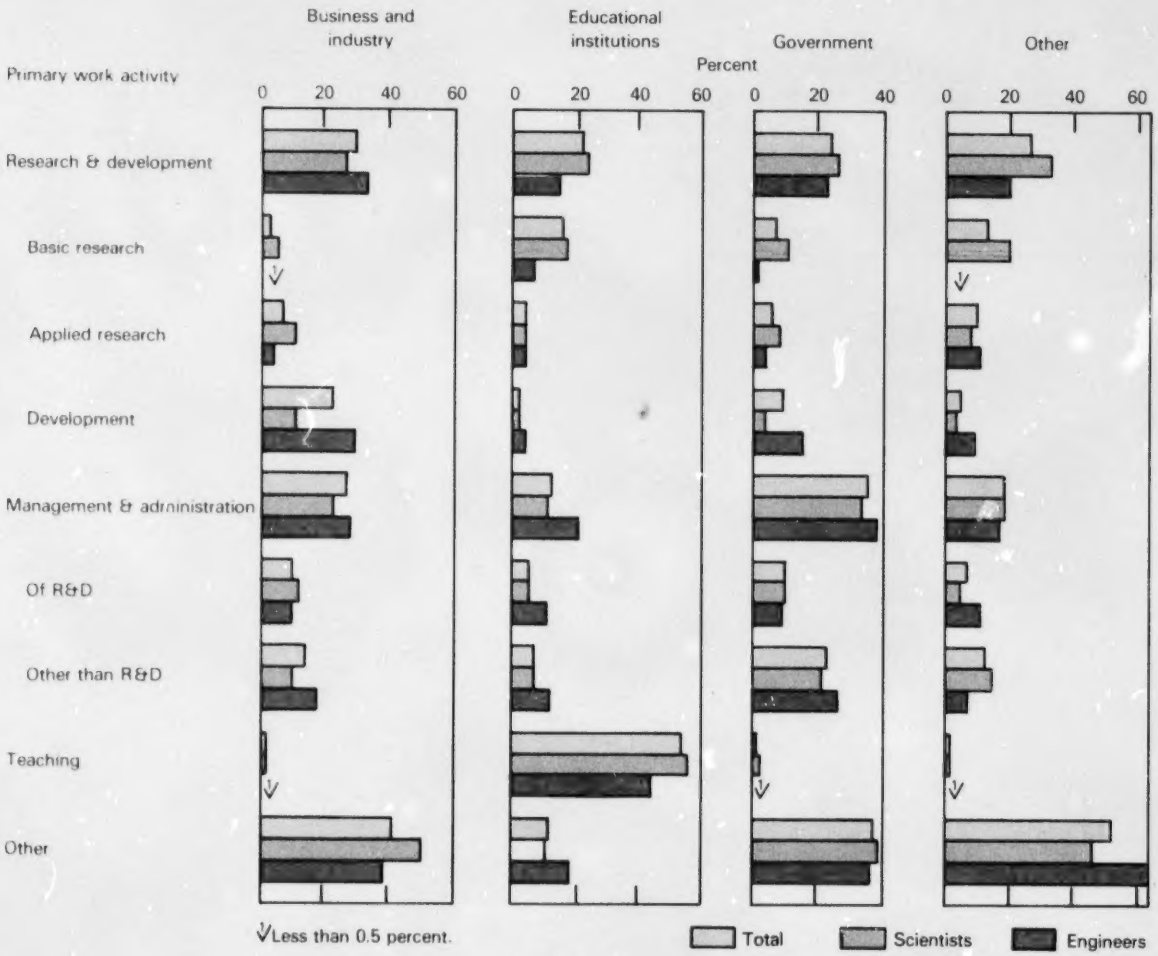


Chart 3. Employed scientists and engineers by primary work activity and type of employer: 1978



SOURCE: National Science Foundation.

Women Scientists and Engineers

There were approximately 266,000 women scientists and engineers in 1978 (about 10 percent of the S/E total) representing a 6-percent growth since 1976. The number of women increased in all fields except for the physical sciences, mathematics, and sociology which declined by about 15 percent. Women engineers, although increasing in number, still constitute less than 2 percent of all engineers, while women scientists accounted for about 18 percent of all scientists. Between 1976 and 1978 the labor force participation rate of S/E women rose from 85 percent to 89 percent, approximately equal to the 91 percent rate of men for the past several years.

Women scientists and engineers reported an unemployment rate of 2.4 percent—2.3 percent for scientists and 3.4[3] for women engineers. The unemployment rate for women scientists was almost twice that of men. The unemployment rate for S/E women was about equal to that of women in the PTK workers group; however, it was about one-half that of women white-collar workers and about one-third that of all women.

EMPLOYED WOMEN SCIENTISTS AND ENGINEERS

Almost 87 percent of the 266,000 S/E women (231,500) were employed in 1978, up 8 percent from 1976 employment level of 197,200.[4] These women were distributed among employers in about the same manner as men. Within business and industry, employed S/E women increased by 17 percent between 1976 and 1978; however, their proportion of industrially employed scientists and engineers remained at around 5 percent. Employment of S/E women increased dramatically in educational institutions during the 2-year period (30 percent). This increased their proportion from 18 percent to 23 percent in this sector. The number in government grew by 19 percent during the period 1976-78 accounting for a total of about 45,000 individuals (chart 4).

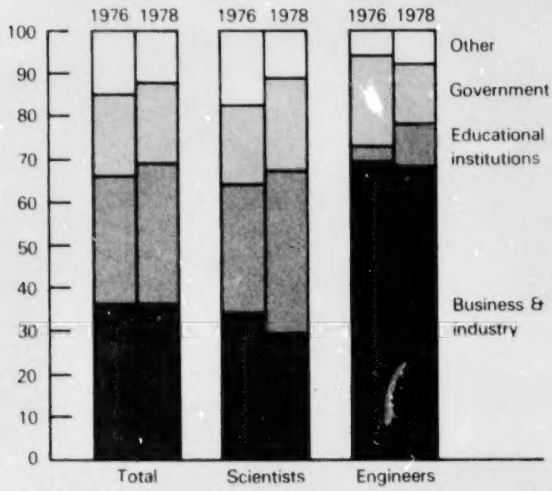
Of the over 231,000 employed S/E women about 91 percent were scientists. R&D activities including the management of research and development were the primary work activities of 30 percent of the women scientists; with report writing, statistical and computing work accounting for the next largest group. About one in five (21 percent) of the women scientists were primarily engaged in teaching. Between 1976 and 1978 teaching as a primary work activity for women scientists grew by 55 percent reflecting the increase of employment in the educational sector. The influx of women into computer specialties (where female S/E employment grew 21 percent) accounts for the large proportion of women scientists engaged in report writing, statistical and computer activities. The growth in R&D activities was about equal to the growth in the number of employed women scientists—23 percent and 22 percent, respectively.

Less than 2 percent of the employed engineers were women. This small number, around 20,000, is not statistically large enough for further disaggregation in terms of sector of employment, primary work activity, or fields of engineering.

* * * * * * * * * * *

U.S. Scientists and Engineers, 1978 (Detailed Statistical Tables) are available from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550.

Chart 4. Women scientists and engineers by type of employer: 1976 and 1978



SOURCE: National Science Foundation.

Footnotes

[1] Of the 2,741,000 scientists and engineers 8.5 percent were outside the labor force. Of the 91.5 percent who were in the labor force (2,508,000) 98.6 percent were employed and 1.4 percent were unemployed and seeking work.

[2] Richard B. Freeman, *The Overeducated American* (New York: Academic Press, 1976), pp. 9-32.

[3] Since the number of women engineers is small, the 3.4 percent unemployment rate has a relative error of about 30 percent.

[4] Of the 266,000 S/E women 11.0 percent were outside the labor force. Of the 89 percent who were in the labor force (237,000) 97.6 percent were employed and 2.4 percent were unemployed and seeking work.